

WE CLAIM:

1. An intelligent gain controller (IGC) for controlling a gain of an on-frequency repeater adapted to mediate RF signal traffic between first and second transceivers of a wireless communications network, the IGC comprising:

a wideband signal path adapted to process RF signals within a respective channel of the communications network;

a narrowband detector adapted to detect a power level of the RF signal traffic within the wideband signal path; and

a micro controller adapted to control a gain of the wideband signal path based on the detected power level of the RF signal traffic.
2. An IGC as claimed in claim 1, wherein respective first and second wideband signal paths are adapted to simultaneously process RF signals within respective uplink and downlink channels of the communications network.
3. An IGC as claimed in claim 2, wherein the narrowband detector and the micro controller are shared by the first and second wideband signal paths.
4. An IGC as claimed in claim 2, wherein each wideband signal path has a bandwidth corresponding to a respective one of an uplink channel bandwidth and a downlink channel bandwidth of the wireless communications network.

5. An IGC as claimed in claim 4, wherein the bandwidth of each channel is about 25 MHz.
6. An IGC as claimed in claim 1, wherein the wideband signal path comprises:
- a first gain control block adapted to selectively control a first gain of the wideband signal path, the first gain being selected to compensate attenuation of the RF signal traffic received by the repeater from the first transceiver; and
 - a second gain control block adapted to selectively control a second gain of the wideband signal path, the second gain being selected to compensate attenuation of the RF signal traffic transmitted by the repeater to the second transceiver.
7. An IGC as claimed in claim 6, wherein the first gain control block is an Automatic Gain Control (AGC) block adapted to control the first signal gain based on a power of the RF signal traffic received from the first transceiver.
8. An IGC as claimed in claim 7, wherein the AGC block comprises:
- a Variable Gain Amplifier (VGA) adapted to control gain of the wideband signal path in response to a gain control signal;
 - an AGC feed-back loop adapted to supply a feedback signal to the VGA as the gain control signal; and
 - a controller adapted to control a power level of the feedback signal supplied to the VGA, in response

2025 RELEASE UNDER E.O. 14176

to an AGC control signal from the micro controller.

9. An IGC as claimed in claim 8, wherein the controller comprises a variable amplifier operatively coupled to receive the AGC control signal from the micro controller.
10. An IGC as claimed in claim 9, wherein the variable amplifier is a variable logarithmic amplifier.
11. An IGC as claimed in claim 8, wherein the AGC feed-back loop further comprises a coupler adapted to supply a sample of RF signals in the wideband signal path to the narrowband detector.
12. An IGC as claimed in claim 6, wherein the second gain control block comprises a slaved variable gain amplifier adapted to selectively control the second signal gain based on a power of RF signals received from the second transceiver.
13. An IGC as claimed in claim 12, wherein the slaved variable gain amplifier is adapted to automatically reduce the second signal gain as the power of RF signals received from the second transceiver increases, and increase the second signal gain as the power of RF signals received from the second transceiver decreases.
14. An IGC as claimed in claim 1, wherein the narrowband detector comprises:

a synthesizer adapted to generate a synthesizer signal having a selected frequency;

an input adapted to receive an RF sample signal from the wideband signal path;

a mixer adapted to generate an intermediate frequency based on the synthesizer signal and the RF sample signal;

a signal isolator adapted to isolate, from the RF sample signal, RF signals lying within a narrow pass-band centered on the intermediate frequency; and

a detector unit adapted to detect at least a power level of the isolated RF signals.

15. An IGC as claimed in claim 14, wherein the synthesizer is adapted to select a frequency of the synthesizer signal using a synthesizer control signal from the micro controller.
16. An IGC as claimed in claim 14, wherein the input comprises a switching input adapted to selectively supply RF signals from one of the first and a second wideband signal paths to the mixer.
17. An IGC as claimed in claim 14, wherein the signal isolator comprises a selectable filter adapted to selectively attenuate a portion of the RF sample signal lying outside the narrow pass-band.
18. A system as claimed in claim 17, wherein the narrow pass-band has a bandwidth of approximately 30kHz.
19. An IGC as claimed in claim 17, wherein the selectable filter is adapted to adjust a bandwidth of the narrow

pass-band in response to a control signal from the micro controller.

20. An IGC as claimed in claim 6, wherein the micro controller comprises:

a micro-processor operatively coupled to each of the first and second gain control blocks and the narrowband detector; and

software defining an Adaptive Control Algorithm for controlling operation of the micro-processor.

21. An IGC as claimed in claim 20, wherein the software comprises software code adapted to:

monitor a power level of RF signals detected by the narrowband detector;

compare the monitored power level to at least one threshold value; and

determine an optimum value of at least the first gain of the wideband signal path using the comparison result.

22. An IGC as claimed in claim 21, wherein the software code adapted to monitor the power level of RF signals, further comprises software code adapted to:

monitor changes in the power level of the RF signal traffic detected by the narrowband detector; and

identify a signal format of the detected RF signals, using the monitored changes.

23. An IGC as claimed in claim 21, further comprising software code adapted to select the threshold value

2025 RELEASE UNDER E.O. 14176

from among a set of predetermined threshold values, using the identified signal format.

24. An IGC as claimed in claim 21, wherein the software code adapted to monitor the power level of RF signals further comprises software code adapted to decorrelate desired RF signal traffic from undesired leakage signals within the wideband signal path.
25. An IGC as claimed in claim 24, wherein the software code adapted to decorrelate desired RF signal traffic from undesired leakage signals comprises software code adapted to:
- inject a predetermined unique code into the wideband signal path;
 - detect a power level of the predetermined unique code in the monitored RF signal; and
 - determine a proportion of leakage signals in the monitored RF signal using on the detected power level of the predetermined unique code in the monitored RF signal.
26. An IGC as claimed in claim 25, further comprising software code adapted to adjust the optimum value of at least the first gain of the wideband signal path using the determined proportion of leakage signals in the monitored RF signals.

2025 RELEASE UNDER E.O. 14176